

**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)	
)	
Implementation of Section 224 of the Act)	WC Docket No. 07-245
)	
A National Broadband Plan for Our Future)	GN Docket No. 09-51
)	
)	
)	
)	

DECLARATION OF DAVID J. MARNE, P.E.

I, David J. Marne, P.E., do hereby state:

1. I am a licensed Professional Engineer and President of Marne and Associates, Inc., an engineering consulting and training firm. I am a member of National Electrical Safety Code® (NESC®) Subcommittee 4, Overhead Lines-Clearances and I am the author of McGraw-Hill's National Electrical Safety Code® (NESC®) 2007 Handbook. Attached is my Curriculum Vitae (Attachment "C").

2. The intent of this document is to address the NESC Rules for pole top communication antenna attachments, a description of the process under which the NESC Rules are written, and information on accepted good industry practice related to reliability issues associated with pole top communication antenna installations. The declaration will also address similar GO95 Rules (California) that apply to pole top installations. Attached are copies of NESC Rules 222, 235I, 239H, title pages from Sections 24, 25, 26, and Rule 420Q (Attachment "B").

3. It is my opinion that communication antennas can be installed in the pole top position on a power pole in a safe and reliable manner using the applicable National Electrical Safety Code (NESC) Rules and accepted good industry practice for the reasons discussed in this document (Attachment "A").

I declare under penalty of perjury that the information and statements contained in this Declaration are true and correct.



David J. Marne, P.E.

October 4, 2010
Date

Attachment A

Declaration of David J. Marne, P.E.



Marne and Associates, Inc.
Experts in Electrical Code

October 4, 2010

DECLARATION OF DAVID J. MARNE, P.E.

Introduction

For many electric utilities, installing a communications antenna in the supply (power) space at the pole top position has become part of their standard practice. These utilities apply the NESC Rules applicable to pole top communication antenna installations combined with accepted good industry practice. These utilities have updated their standard drawings and specifications to provide information for wireless companies to use when applying for and installing pole top communication antennas. These electric utilities have recognized a change in the industry and they have adapted to that change.

Some electric utilities continue to resist this change in the utility industry. These utilities deny applications for communication antenna pole top installations on their systems, in particular communication pole top antennas on primary distribution poles (typically 12 kV and above) and transmission poles (typically 69 kV and above). With the existence of NESC Rules addressing the clearance (distance between the pole top antenna and the power line) and NESC Rules addressing the strength and loading (ice and wind loads), electric utilities should not be denying pole top communication antenna attachments.

NESC Review

Prior to discussing the applicable National Electrical Safety Code (NESC) Rules, it is important to note how the NESC Rules are written and who serves on the NESC committees. The NESC committee members are not paid; they are volunteer members that represent various organizations including electric utility organizations, communication utility organizations, engineers, contractors, trade unions, and safety organizations. Anyone can propose an addition, deletion, or change to an NESC Rule. The change proposal is reviewed and voted on by the appropriate NESC committee, released for public comment, then reviewed and voted on again after the public comment period. This process is done accordance with the procedures of the American National Standards Institute (ANSI). The NESC is currently revised on a 5 year cycle.

Below is a summary of the current Rules that apply to pole top installations on primary distribution and transmission poles.

NESC Rule 222, Joint use of structures

This Rule encourages the consideration of joint use of structures (poles and towers). This Rule focuses on joint use of power and communication lines, realizing that duplicate pole lines may not be in the best interest of the utilities or the public. This same concept can be applied to joint use of communication antennas and power poles. The Rule requires "cooperative consideration." The same cooperative consideration is needed when an electric utility and a wireless attacher work together on the installation of a pole top communications antenna. Some electric utilities will deny the pole top installation and require that the communications antenna be located in the communications space down lower on the pole. The wireless attacher typically desires the higher pole top position due to coverage area issues.

NESC Rule 235I, Clearances in any direction from supply line conductors to communication antennas in the supply space attached to the same supporting structure

This Rule is notably the most frequently referenced Rule with respect to pole top communication antennas as this Rule was written specifically for their installation. This Rule is used in conjunction with other NESC Rules. An example of how to apply this Rule shown in McGraw-Hill NESC 2007 Handbook, page 248, which is reproduced below.

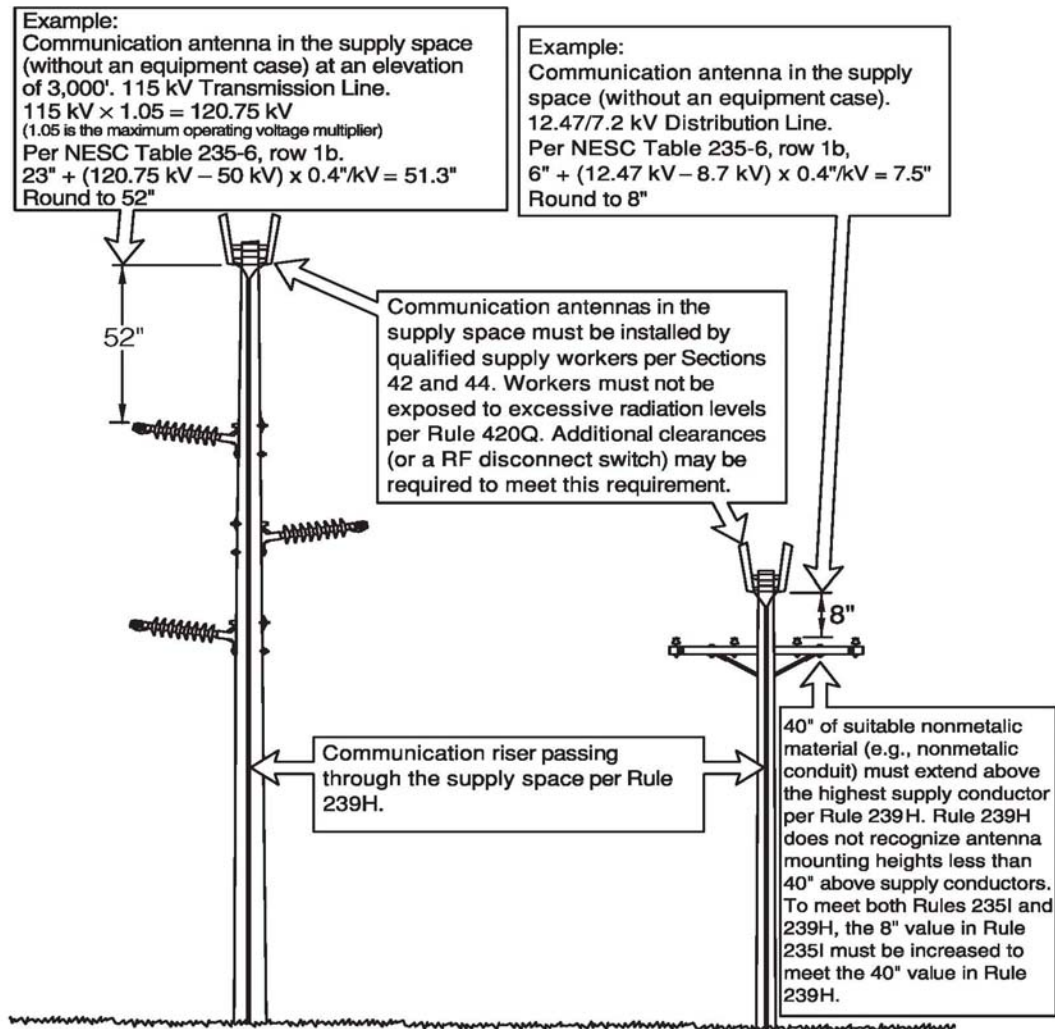


Fig. 235-20. Examples of clearance between supply lines and communication antennas in the supply space (Rule 235I).

NESC Rule 239H, Requirements for vertical communication conductors passing through supply space on jointly used structures

This Rule addresses the safe installation practice for the connection (conduit and wire) between the communications antenna in the pole top position and the communications equipment near the base of the pole.

NESC Sections 24, 25, and 26, Grades of construction, Loadings for Grades B and C, and Strength requirements

These Sections (multiple rules) address the safe installation practices related to ice and wind loads on lines and equipment. The NESC rules in these sections are applicable to electric power lines and electric power equipment as well as communications lines and communications equipment (including antennas). It is possible for the pole top conductor on a power pole (energized phase or grounded static) to have more weight and a larger wind surface area (when considering the wind span length and weight span length) than a pole top antenna.

The NESC rules in these sections protect the general public from falling energized lines and equipment and from falling communication lines and equipment. The grade of construction (or degree of safety factor) is higher for energized lines and equipment compared to communication lines and equipment due to the higher danger that energized lines impose. However, when communications lines and equipment are attached to power poles the NESC requires that the communication lines and equipment be attached using the same grade of construction (safety factor) as the energized lines.

NESC Rule 420Q, Communication antennas

NESC Rule 420Q addresses worker exposure to radio frequencies. The wireless attacher performs radio frequency (RF) calculations to comply with NESC Rule 420Q. This issue is also addressed in some cases with RF warning signs and RF disconnect switches.

Installation of a communications antenna in the pole top position does take cooperation between the parties involved but the basic provisions for safety are addressed in the NESC.

Reliability Issues

Electric utilities that do permit pole top communication antenna installations on primary voltage poles and transmission voltage poles use accepted good industry practice to deal with any reliability issues. Some electric utilities recognize that the NESC addresses the safety issues related to pole top antennas but deny the pole top installation due to reliability issues.

Below is a summary of typical reliability issues that apply to pole top installations on primary distribution and transmission poles, and how many electric utilities have applied accepted good industry practice to deal with the issues.

Lightning issues

Lightning issues can be resolved by grounding and bonding per the NESC and the National Electrical Code (NEC). Electric utilities use the NEC for accepted good practice as the NEC applies to building wiring systems. The NEC contains rules and information on grounding, bonding, and surge arrestors for antenna systems. Basic impulse levels (BIL) related to lightning and overvoltage can be resolved using surge arrestors and/or higher voltage insulators. Where a lightning protection static or shield wires exists the

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antenna can be mounted above the level of the lightning protection or shield wire and properly grounded, bonded, and surge protected.

Antenna supports

The antenna supports require the same strength and loading analysis (NESC Sections 24, 25, and 26) as the power line hardware. The same type of mounting bolts and brackets used to support power line insulators and equipment can be used to support the communications antenna.

Live line work (hot work)

The safety rules for working around energized (live or hot) conductors are provided in Part 4 of the NESC and in OSHA Standard 1910.269. A grounded transformer case, a grounded lightning arrestor, a grounded static wire, and even a grounded steel pole are common examples of grounded equipment in close proximity to energized power facilities. The same work rules used to work safely on an energized power line in the vicinity of grounded power line equipment are used to work around the communications antenna. The same skill and care used around this equipment would be used by crews around the communications antenna.

GO95 Review

The NESC is used by utility companies in 49 of the 50 states. The State of California is the exception. The State of California writes its own utility code book called General Order 95 (GO95). GO95 contains similar or parallel rules to the NESC. Just like the NESC, GO95 contains rules for mounting a communications antenna in the pole top position. The rules include clearance (distance between the antenna and the power line) and strength and loading (ice and wind loading).

Summary

The NESC pole top communication antenna rules (NESC Rule 235I) were introduced in the 2002 Edition of the NESC which was published on August 1, of 2001. Electric utilities that deny applications for pole top communications antennas on primary voltage and transmission voltage poles are not recognizing the safety rules in place to do so and accepted good practice in the industry. It is my opinion that communication antennas can be installed in the pole top position on a power pole in a safe and reliable manner using the applicable National Electrical Safety Code (NESC) Rules and accepted good industry practice.

The following 4 photos provide visual explanations of the information discussed in this document.

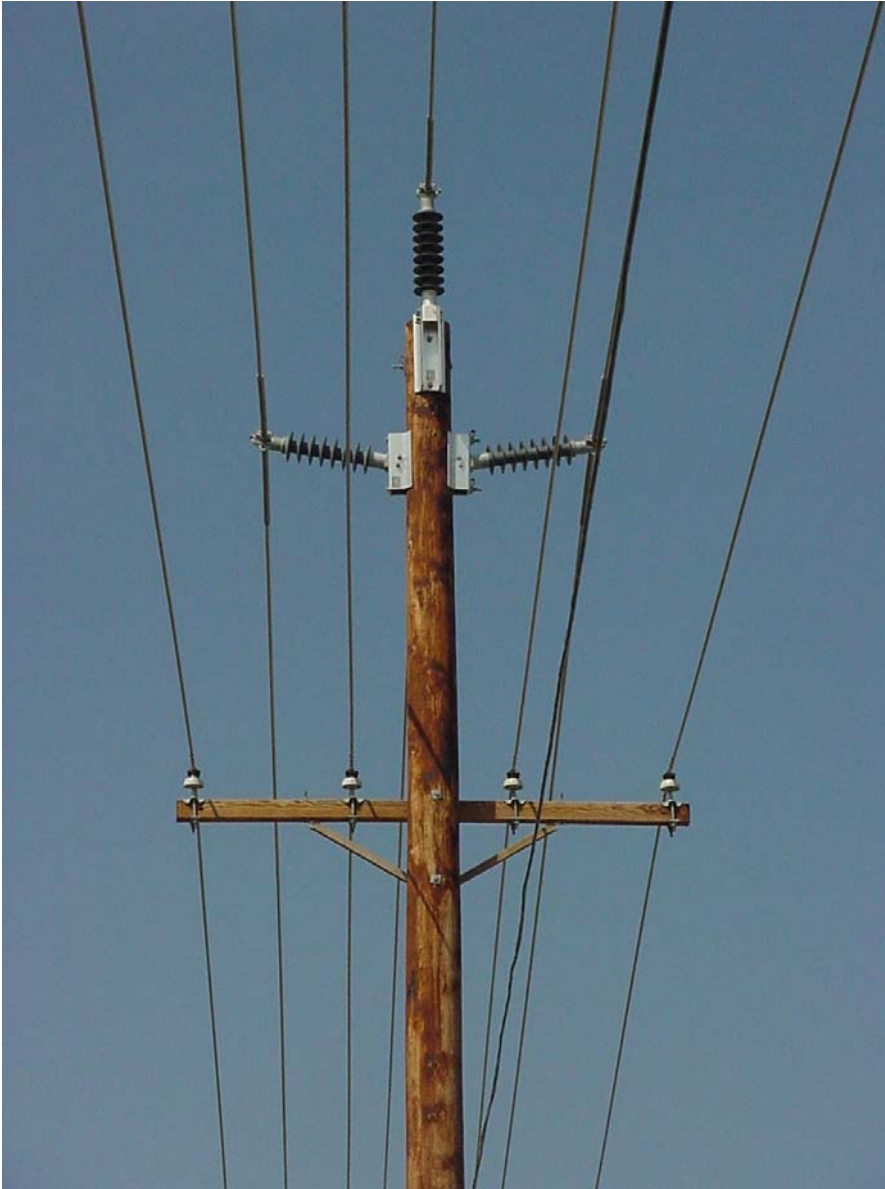


Photo of a double circuit power line. The same strength and loading (ice and wind load) analysis and the same attachment hardware (nuts and bolts) used to mount the top circuit above the bottom circuit can be used to mount a communications antenna above the power line.



Photo of a power pole with a fused cutout, grounded transformer, and street light. The same safe work practices that a power lineman uses to work on the power line adjacent to this equipment are used to work on the power line adjacent to a pole top communications antenna.



Application of NESC Rules and accepted good industry practice to mount a communications pole top antenna above a 12 kV distribution line.



Application of NESC Rules and accepted good industry practice to mount a communications pole top antenna above a 115 kV transmission line.

Attachment B

NESC® Rules 222, 235I, 239H, title pages from Sections 24, 25, 26, and Rule 420Q

Communication circuits other than those used in connection with the operation of the supply circuits shall not be carried in the same cable with such supply circuits.

- f. Where such supply conductors are carried below communication conductors, transformers and other apparatus associated therewith shall be attached only to the sides of the support arm in the space between and at no higher level than such supply wires.
- g. Lateral runs of such supply circuits carried in a position below the communication space shall be protected through the climbing space by wood molding or equivalent covering, or shall be carried in insulated multiple-conductor cable, and such lateral runs shall be placed on the underside of the support arm.

C. Relative levels: Supply lines of different voltage classifications (0 to 750 V, over 750 V to 8.7 kV, over 8.7 kV to 22 kV, and over 22 kV to 50 kV)

1. At crossings or conflicts

Where supply conductors of different voltage classifications cross each other or structure conflict exists, the higher-voltage lines should be carried at the higher level.

2. On structures used only by supply conductors

Where supply conductors of different voltage classifications are on the same structures, relative levels should be as follows:

- a. Where all circuits are owned by one utility, the conductors of higher voltage should be placed above those of lower voltage.
- b. Where different circuits are owned by separate utilities, the circuits of each utility may be grouped together, and one group of circuits may be placed above the other group provided that the circuits in each group are located so that those of higher voltage are at the higher levels and that any of the following conditions is met:

- (1) A vertical clearance of not less than that required by Table 235-5 is maintained between the nearest line conductors of the respective utilities.
- (2) Conductors of a lower voltage classification placed at a higher level than those of a higher classification shall be placed on the opposite side of the structure.
- (3) Ownership and voltage are prominently displayed.

D. Identification of overhead conductors

All conductors of electric supply and communication lines should, as far as is practical, be arranged to occupy uniform positions throughout, or shall be constructed, located, marked, numbered, or attached to distinctive insulators or crossarms, so as to facilitate identification by employees authorized to work thereon. This does not prohibit systematic transposition of conductors.

E. Identification of equipment on supporting structures

All equipment of electric supply and communication lines should be arranged to occupy uniform positions throughout or shall be constructed, located, marked, or numbered so as to facilitate identification by employees authorized to work thereon.

221. Avoidance of conflict

Two separate lines, either of which carries supply conductors, should be so separated from each other that neither conflicts with the other. If this is not practical, the conflicting line or lines should be separated as far as practical and shall be built to the grade of construction required by Section 24 for a conflicting line, or the two lines shall be combined on the same structures.

222. Joint use of structures

Joint use of structures should be considered for circuits along highways, roads, streets, and alleys. The choice between joint use of structures and separate lines shall be determined through

cooperative consideration of all the factors involved, including the character of circuits, the total number and weight of conductors, tree conditions, number and location of branches and service drops, structure conflicts, availability of right-of-way, etc. Where such joint use is mutually agreed upon, it shall be subject to the appropriate grade of construction specified in Section 24.

223. Communications protective requirements

A. Where required

Where communication apparatus is handled by other than qualified persons, it shall be protected by one or more of the means listed in Rule 223B if such apparatus is permanently connected to lines subject to any of the following:

1. Lightning
2. Contact with supply conductors whose voltage to ground exceeds 300 V
3. Transient rise in ground potential exceeding 300 V
4. Steady-state induced voltage of a hazardous level

Where communication cables will be in the vicinity of supply stations where large ground currents may flow, the effect of these currents on communication circuits should be evaluated.

NOTE: Additional information may be obtained from IEEE Std 487™-2000 [B34] and 1590™-2003 [B54].

B. Means of protection

Where communication apparatus is required to be protected under Rule 223A, protective means adequate to withstand the voltage expected to be impressed shall be provided by insulation, protected where necessary by surge arresters used in conjunction with fusible elements. Severe conditions may require the use of additional devices such as auxiliary arresters, drainage coils, neutralizing transformers, or isolating devices.

224. Communication circuits located within the supply space and supply circuits located within the communication space

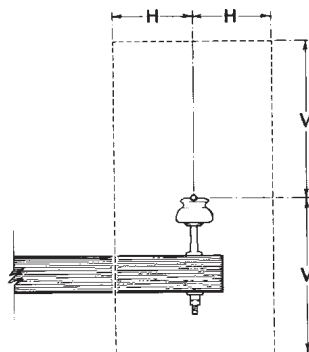
A. Communication circuits located in the supply space

1. Communication circuits located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space in accordance with the applicable rules of Sections 42 and 44.
2. Communication circuits located in the supply space shall meet the following clearance requirements, as applicable:
 - a. Insulated communication cables supported by an effectively grounded messenger shall have the same clearances as neutrals meeting Rule 230E1 from communication circuits located in the communication space and from supply conductors located in the supply space. See Rules 235 and 238.
 - b. Fiber-optic cables located in the supply space shall meet the requirements of Rule 230F.
 - c. Open-wire communication circuits permitted by other rules to be in the supply space shall have the same clearances from communication circuits located in the communication space and from other circuits located in the supply space as required by Rule 235 for ungrounded open supply conductors of 0–750 V.

EXCEPTION: Service drops meeting Rules 224A3a and 224A3b may originate in the supply space on a line structure or in the span and terminate in the communication space on the building or structure being served.

3. Communication circuits located in the supply space in one portion of the system may be located in the communication space in another portion of the system if the following requirements are met:

3. Conductors shall be arranged so that the vertical spacing shall be not less than that specified in Table 235-8 under the conditions specified in Rule 235C2b(1)(c)
 4. A supporting neutral conductor of a supply cable meeting Rule 230C3 or an effectively grounded messenger of a supply cable meeting Rule 230C1 or 230C2 may attach to the same insulator or bracket as a neutral conductor meeting Rule 230E1, so long as the clearances of Table 235-8 are maintained in mid-span and the insulated energized conductors are positioned away from the open supply neutral at the attachment.
- H. Clearance and spacing between communication conductors, cables, and equipment
1. The spacing between messengers supporting communication cables should be not less than 300 mm (12 in) except by agreement between the parties involved.
 2. The clearances between the conductors, cables, and equipment of one communication utility to those of another, anywhere in the span, shall be not less than 100 mm (4 in), except by agreement between the parties involved.
- I. Clearances in any direction from supply line conductors to communication antennas in the supply space attached to the same supporting structure
1. General
Communication antennas located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space in accordance with the applicable rules of Sections 42 and 44. See also Rule 224A.
 2. Communication antenna
The clearance between a communication antenna operated at a radio frequency of 3 kHz to 300 GHz and a supply line conductor shall be not less than the value given in Table 235-6, row 1b.
NOTE 1: The antenna functions as a rigid, vertical, or lateral open wire communication conductor.
NOTE 2: See Rule 420Q.
 3. Equipment case that supports a communication antenna
The clearance between an equipment case that supports a communication antenna and a supply line conductor shall be not less than the value given in Table 235-6, Row 4a.
 4. Vertical or lateral communication conductors and cables attached to a communication antenna
The clearance between a supply line conductor and the vertical or lateral communication conductor and cable attached to a communication antenna shall be not less than the value given in Rule 239.



V = Vertical clearance

H = Horizontal clearance

Figure 235-1—Clearance diagram for energized conductor

EXCEPTION: Vertical runs of effectively grounded supply conductors may have a clearance of 25 mm (1 in).

H. Requirements for vertical communication conductors passing through supply space on jointly used structures

All vertical runs of communication conductors passing through supply space shall be installed as follows:

1. Metal-sheathed communication cables

Vertical runs of metal-sheathed communication cables shall be covered with suitable nonmetallic material, where they pass trolley feeders or other supply line conductors. This nonmetallic covering shall extend from a point 1.0 m (40 in) above the highest trolley feeders or other supply conductors, to a point 1.80 m (6 ft) below the lowest trolley feeders or other supply conductors, but need not extend below the top of any mechanical protection that may be provided near the ground.

EXCEPTION 1: Communication cables may be run vertically on the pole through space occupied by railroad signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

2. Communication conductors

Vertical runs of insulated communication conductors shall be covered with suitable nonmetallic material, to the extent required for metal-sheathed communication cables in Rule 239H1, where such conductors pass trolley feeders or supply conductors.

EXCEPTION 1: Communication conductors may be run vertically on the structure through space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

3. Communication grounding conductors

Vertical communication grounding conductors shall be covered with suitable nonmetallic material between points at least 1.80 m (6 ft) below and 1.0 m (40 in) above any trolley feeders or other supply line conductors by which they pass.

EXCEPTION 1: Communication grounding conductors may be run vertically on the structure through space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

4. Clearance from through bolts and other metal objects

Vertical runs of communication conductors or cables shall have a clearance of one-eighth of the pole circumference but not less than 50 mm (2 in) from exposed through bolts and other exposed metal objects attached thereto that are associated with supply line equipment.

EXCEPTION: Vertical runs of effectively grounded communication cables may have a clearance of 25 mm (1 in).

I. Operating rods

Effectively grounded or insulated operating rods of switches are permitted to pass through the communication space, but shall be located outside of the climbing space.

J. Additional rules for standoff brackets

1. Standoff brackets may be used to support the conduit(s). Cable insulation appropriate for the intended service is required; non-metallic conduit shall not be used to meet basic insulation requirements.

NOTE: See Rule 217A2.

Section 24.

Grades of construction

240. General

- A. The grades of construction are specified in this section on the basis of the required strengths for safety. Where two or more conditions define the grade of construction required, the grade used shall be the highest one required by any of the conditions.
- B. For the purposes of this section, the voltage values for direct-current circuits shall be considered equivalent to the rms values for alternating-current circuits.

241. Application of grades of construction to different situations

- A. Supply cables

For the purposes of these rules, supply cables are classified by two types as follows:

Type 1—Supply cables conforming to Rule 230C1, 230C2, or 230C3 shall be installed in accordance with Rule 261I.

Type 2—All other supply cables are required to have the same grade of construction as open-wire conductors of the same voltage.

- B. Order of grades

The relative order of grades for supply and communication conductors and supporting structures is B, C, and N, with Grade B being the highest.

- C. At crossings

Wires, conductors, or other cables of one line are considered to be at crossings when they cross over another line, whether or not on a common supporting structure, or when they cross over or overhang a railroad track, the traveled way of a limited access highway, or navigable waterways requiring waterway crossing permits. Joint-use or collinear construction in itself is not considered to be at crossings.

- 1. Grade of upper line

Conductors and supporting structures of a line crossing over another line shall have the grade of construction specified in Rules 241C3, 242, and 243.

- 2. Grade of lower line

Conductors and supporting structures of a line crossing under another line need only have the grades of construction that would be required if the line at the higher level were not there.

- 3. Multiple crossings

- a. Where a line crosses in one span over two or more other lines, or where one line crosses over a span of a second line, which span in turn crosses a span of a third line, the grade of construction of the uppermost line shall be not less than the highest grade that would be required of either one of the lower lines when crossing the other lower line.
- b. Where communication conductors cross over supply conductors and railroad tracks in the same span, the grades of construction shall be in accordance with Grade B construction. It is recommended that the placing of communication conductors above supply conductors generally be avoided unless the supply conductors are trolley-contact conductors and their associated feeders.

- D. Conflicts (see Section 2, **structure conflict**)

The grade of construction of the conflicting structure shall be as required by Rule 243A4.

Section 25. Loadings for Grades B and C

250. General loading requirements and maps

A. General

1. It is necessary to assume the wind and ice loads that may occur on a line. Three weather loadings are specified in Rules 250B, 250C, and 250D. Where all three rules apply, the required loading shall be the one that has the greatest effect.
2. Where construction or maintenance loads exceed those imposed by Rule 250A1, the assumed loadings shall be increased accordingly. When temporary loads, such as lifting of equipment, stringing operations, or a worker on a structure or its component, are to be imposed on a structure or component, the strength of the structure or component should be taken into account or other provisions should be made to limit the likelihood of adverse effects of structure or component failure.

NOTE: Other provisions could include cranes that can support the equipment loads, guard poles and spotters with radios, and stringing equipment capable of promptly halting stringing operations.

3. It is recognized that loadings actually experienced in certain areas in each of the loading districts may be greater, or in some cases, may be less than those specified in these rules. In the absence of a detailed loading analysis, using the same respective statistical methodologies used to develop the maps in Rule 250C or 250D, no reduction in the loadings specified therein shall be made without the approval of the administrative authority.
4. The structural capacity provided by meeting the loading and strength requirements of Sections 25 and 26 provides sufficient capability to resist earthquake ground motions.

B. Combined ice and wind district loading

Three general degrees of district loading due to weather conditions are recognized and are designated as heavy, medium, and light loading. Figure 250-1 shows the districts where these loadings apply.

NOTE: The localities are classified in the different loading districts according to the relative simultaneous prevalence of the wind velocity and thickness of ice that accumulates on wires. Light loading is for places where little, if any, ice accumulates on wires.

Table 250-1 shows the radial thickness of ice and the wind pressures to be used in calculating loads. Ice is assumed to weigh 913 kg/m^3 (57 lb/ft^3).

C. Extreme wind loading

If no portion of a structure or its supported facilities exceeds 18 m (60 ft) above ground or water level, the provisions of this rule are not required, except as specified in Rule 261A1c, 261A2e, or 261A3d. Where a structure or its supported facilities exceeds 18 m (60 ft) above ground or water level the structure and its supported facilities shall be designed to withstand the extreme wind load associated with the Basic Wind Speed, as specified by Figure 250-2. The wind pressures calculated shall be applied to the entire structure and supported facilities without ice. The following formula shall be used to calculate wind load.

$$\text{Load in newtons} = 0.613 \cdot (V_{m/s})^2 \cdot k_z \cdot G_{RF} \cdot I \cdot C_f \cdot A(m^2)$$

$$\text{Load in pounds} = 0.00256 \cdot (V_{mi/h})^2 \cdot k_z \cdot G_{RF} \cdot I \cdot C_f \cdot A(ft^2)$$

Section 26. Strength requirements

260. General (see also Section 20)

A. Preliminary assumptions

1. It is recognized that deformation, deflections, or displacement of parts of the structure may change the effects of the loads assumed. In the calculation of stresses, allowance may be made for such deformation, deflection, or displacement of supporting structures including poles, towers, guys, crossarms, pins, conductor fastenings, and insulators when the effects can be evaluated. Such deformation, deflection, or displacement should be calculated using Rule 250 loads prior to application of the load factors in Rule 253. For crossings or conflicts, the calculations shall be subject to mutual agreement.
2. It is recognized that new materials may become available. While these materials are in the process of development, they must be tested and evaluated. Trial installations are permitted where the requirements of Rule 13A2 are met.

B. Application of strength factors

1. Structures shall be designed to withstand the appropriate loads multiplied by the load factors in Section 25 without exceeding their strength multiplied by the strength factors in Section 26.

NOTE: The latest edition of the following document may be used for providing information for determining the 5% lower exclusion limit strength of a FRP structure or component for use with an appropriate strength factor (Table 261-1A) and the specified NESC loads and load factors (Table 253-1): ASCE-111, Reliability-Based Design of Utility Pole Structures.

2. Unless otherwise specified, a strength factor of 0.80 shall be used for the extreme wind loading conditions specified in Rule 250C and for the extreme ice with concurrent wind specified in Rule 250D for all supported facilities.

NOTE: The latest edition (unless a specific edition is referenced) of the following documents are among those available for determining structure design capacity with the specified NESC loads, load factors, and strength factors:

ANSI/ASCE-10, Design of Latticed Steel Transmission Structures

ASCE-91, Design of Guyed Electrical Transmission Structure

ASCE-PCI, Guide for the Design of Prestressed Concrete Poles

ASCE-72, Design of Steel Transmission Pole Structures

ASCE-104, Recommended Practice For Fiber-Reinforced Polymer Products For Overhead Utility Line Structures

PCI, Design Handbook-Precast and Prestressed Concrete

ACI-318, Building Code Requirements for Structural Concrete (for reinforced concrete designs)

ACI-318, 1983, Building Code Requirements for Structural Concrete (for anchor bolt bond strength)

IEEE Std 751TM-1990, IEEE Trial-Use Design Guide for Wood Transmission Structures [B38]

AISI, Specification for the Design of Cold-Formed Steel Structural Members

The Aluminum Association, Aluminum Design Manual

261. Grades B and C construction

A. Supporting structures

The strength requirements for supporting structures may be met by the structures alone or with the aid of guys or braces or both.

O. Cable reels

Cable reels shall be securely blocked so they cannot roll or rotate accidentally.

P. Street and area lighting

1. The lowering rope or chain, its supports, and fastenings shall be examined periodically.
2. A suitable device shall be provided by which each lamp on series-lighting circuits of more than 300 V may be safely disconnected from the circuit before the lamp is handled.

EXCEPTION: This rule does not apply where the lamps are always worked on from suitable insulated platforms or aerial lift devices, or handled with suitable insulated tools, and treated as under full voltage of the circuit concerned.

Q. Communication antennas

When working in the vicinity of communication antennas operating in the range of 3 kHz to 300 GHz, workers shall not be exposed to radiation levels that exceed those set forth by the regulatory authority having jurisdiction.

NOTE: See OSHA 29 CFR 1910.97, Subpart G [B63]; OSHA 29 CFR 1910.268, Subpart R [B64]; FCC Bulletin No. 65 [B30]; IEEE Std C95.1TM-2005 [B57].

421. General operating routines

A. Duties of a first-level supervisor or person in charge

This individual shall:

1. Adopt such precautions as are within the individual's authority to prevent accidents.
2. See that the safety rules and operating procedures are observed by the employees under the direction of this individual.
3. Make all the necessary records and reports, as required.
4. Prevent unauthorized persons from approaching places where work is being done, as far as practical.
5. Prohibit the use of tools or devices unsuited to the work at hand or that have not been tested or inspected as required.

B. Area protection

1. Areas accessible to vehicular and pedestrian traffic
 - a. Before engaging in work that may endanger the public, safety signs or traffic control devices, or both, shall be placed conspicuously to alert approaching traffic. Where further protection is needed, suitable barrier guards shall be erected. Where the nature of work and traffic requires it, a person shall be stationed to warn traffic while the hazard exists.
 - b. When openings or obstructions in the street, sidewalk, walkways, or on private property are being worked on or left unattended during the day, danger signals, such as warning signs and flags, shall be effectively displayed. Under these same conditions at night, warning lights shall be prominently displayed and excavations shall be enclosed with protective barricades.
2. Areas accessible to employees only
 - a. If the work exposes energized or moving parts that are normally protected, safety signs shall be displayed. Suitable barricades shall be erected to restrict other personnel from entering the area.
 - b. When working in one section where there is a multiplicity of such sections, such as one panel of a switchboard, one compartment of several, or one portion of a substation, employees shall mark the work area conspicuously and place barriers to prevent accidental contact with energized parts in that section or adjacent sections.

Attachment C

Curriculum Vitae of David J. Marne, P.E.

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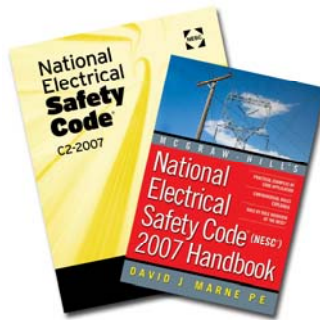
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David J. Marne, P.E.

David J. Marne, P.E. is a registered professional electrical engineer. Mr. Marne is the author of *McGraw-Hill's National Electrical Safety Code® (NESC®) Handbook* and is a nationally recognized speaker on the NESC®. He serves on NESC® Subcommittee 4, Overhead Lines – Clearances. He is company president and senior electrical engineer for Marne and Associates, Inc. in Missoula, Montana where he specializes in National Electrical Safety Code® (NESC®) training, OSHA training, and engineering design. Mr. Marne has over 26 years of experience in the utility industry engineering and managing transmission and distribution line projects, substation projects, electrical system planning studies, joint use (power and communication) projects, and providing training and expert witness services.



The 2007 National Electrical Safety Code® (NESC®) (above left) and McGraw-Hill's NESC® Handbook authored by David J. Marne, PE (above right)

Education

Montana State University, Bozeman, Montana
Bachelor of Science in Electrical Engineering (BSEE)
Graduation Date: June 1983

Various Continuing Education Courses, 1983-present
Transmission and Distribution Line Design and Staking, Substation Design, System Protection and Coordination, System Over-voltage Design, Engineering and Operations Conferences, Pole Conferences, Joint Use (Power and Communications) Conferences, Electromagnetic Fields (EMF), Corrosion Control, Project Management, Finance and Accounting, OSHA Compliance and Workplace Safety, OSHA 1910.269 Qualified Worker, National Electrical Safety Code® (NESC®) Sub-Committee Meetings, California General Order 95 (GO95) Rule Making Sessions.

Experience

Transmission and Distribution Line Engineering

Responsible for the engineering management and/or engineering design of over 40 transmission line related projects and over 225 distribution line related projects. Projects have involved a variety of voltage levels, conductor sizes, structure types, terrain types, right-of-way constraints, and environmental issues. Designs for transmission and distribution lines include both overhead and underground circuits (including underwater locations) in both urban and rural settings. Engineering services provided for transmission and distribution engineering projects include planning, cost estimating, design, bidding, construction administration, construction observation, right-of-way, and permitting.

Substation Engineering

Responsible for the engineering management and/or engineering design of over 60 substation related projects. Projects have involved a variety of voltage levels, transformer ratings, bus sizes, structure types, site plans, grounding issues, protection schemes, metering types, communication systems, ownership, and environmental issues. Designs for substations include both live front and dead front equipment in both urban and rural settings. Engineering services for substation projects include planning, cost estimating, design, bidding, construction administration, construction observation, site work, and permitting.

Electrical System Planning Studies

Responsible for the engineering management and/or engineering design of over 95 electrical system planning related studies. Projects have involved a variety of studies including long range plans, construction work plans, sectionalizing and coordination studies, voltage drop studies, fault current studies, motor starting studies, power factor analysis, electromagnetic field (EMF) reports, and environmental studies.

Joint Use (Power and Communication) Engineering

Responsible for the engineering management and/or engineering design of over 25 joint use (power and communication) related projects. Projects have involved a variety of power line voltage levels and communication line (phone, CATV, fiber) cable types. Engineering services include calculating and reviewing clearance, and strength and loading issues in accordance with the National Electrical Safety Code® (NESC®) and Joint Use Agreements. Services also include field data gathering, determining make-ready requirements, and field construction observation.

National Electrical Safety Code® (NESC®) and Related Standards

Nationally recognized expert on the National Electrical Safety Code® (NESC®). Author of *McGraw-Hill's NESC® Handbook* and presenter of NESC® seminars around the United States. (See Publications and Presentations for additional information.)

Expert in the Occupational Safety and Health (OSHA) Standards that apply to power and communication utilities including OSHA Standards 1910.269, 1910.268, and 1926.950 through 1926.960. Expert in the California General Orders related to the electrical power and communication utility industries (GO95, GO128, and GO165). Expert in the National Electrical Code® (NEC®) rules that relate to the utility service point.

Expert Witness Services

Expert witness services and electrical investigations for cases involving power line contacts, electrocution, pole strength and loading, guy wire contacts, lineman work rules, roadway clearances, building clearances, power failure, fires, and electrical service failures resulting in loss of life, injury, and/or property damage. Electrical investigations related to power theft and stray voltage complaints. Electrical investigations related to electromagnetic field (EMF) concerns. Services for defense and plaintiff attorneys and insurance companies. (Expert witness testimony list provided upon request).

Management Experience

President and CEO of Marne and Associates, Inc. Responsible for all aspects of corporate management and company direction.

Branch Manager of SSR Engineers, Inc., Missoula, Montana office. Responsibilities included administration, marketing, and engineering. Reported directly to the company president of an 80+ employee firm spread across five offices. Elected to SSR Engineers, Inc. Board of Directors in 1998 and served as a trustee on the Board of Directors until SSR Engineers was purchased by HDR Engineering in 2003.

Department Manager of the Transmission and Distribution (T&D) group of HDR Engineering in Missoula, Montana. Similar management duties as described above in addition to maintaining relationships with other managers and corporate personnel throughout a 3200+ employee firm with over 80 offices.

Work History

Marne and Associates, Inc.

Missoula, Montana 2005-Present

President

President of Marne and Associates, Inc. which provides National Electrical Safety Code[®] (NESC[®]) training (public seminars, in-house seminars, and web based training), OSHA training, training aids (software, books, manuals, etc.), accident investigation, expert witness services, and engineering design.

HDR Engineering, Inc.

Missoula, Montana 2003-2005

Transmission and Distribution Department Manager/Senior Electrical Engineer
(HDR Engineering purchased SSR Engineers on 8/1/03)

Department manager and senior electrical engineer in charge of electrical engineering design for electric utility clients and National Electrical Safety Code[®] (NESC[®]) presentations.

SSR Engineers, Inc.

Missoula, Montana 1990-2003

Branch Manager/Senior Electrical Engineer

Branch manager and senior electrical engineer in charge of electrical engineering design for electric utility clients and National Electrical Safety Code[®] (NESC[®]) presentations.

Project Engineer 1988-1990

(SSR Engineers purchased General Engineers on 3/1/88)

Project electrical engineer involved with electrical power, lighting, and communication projects for utility, industrial, and commercial clients.

General Engineers, Inc.

Missoula, Montana 1985-1988

Design Engineer

Design electrical engineer involved with electrical power, lighting, and communication projects for utility, industrial, and commercial clients.

Mare Island Naval Shipyard

Vallejo, California 1983-1985

Design Engineer

Design electrical engineer involved with electrical power, lighting, and communication projects for the public works department of a naval shipyard.

Publications

Marne, David J., *McGraw-Hill's National Electrical Safety Code® (NESC®) 2007 Handbook*, Conforms to the 2007 NESC®, McGraw-Hill Publishing, New York, NY, 2007

Marne, David J., *McGraw-Hill's National Electrical Safety Code® (NESC®) Handbook*, Conforms to the 2002 NESC®, McGraw-Hill Publishing, New York, NY, 2002

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Presentations

- Applying the National Electrical Safety Code® (NESC®) to Day-to-Day Utility Work
Presented at various utility companies and utility associations across the United States.
- Applying the National Electrical Safety Code® (NESC®) to Day-to-Day Utility Work – Transmission Voltage Focus
Presented at various utility companies across the United States.
- National Electrical Safety Code® (NESC®) Rules for Joint Use Construction
Presented at various utility companies and utility associations across the United States.
- Major Changes and General Overview of the 2007 National Electrical Safety Code® (NESC®)
Presented at various utility companies and utility associations across the United States.
- Major Changes and General Overview of the 2002 National Electrical Safety Code® (NESC®)
Presented at various utility companies and utility associations across the United States.
- Major Changes and General Overview of the 1997 National Electrical Safety Code® (NESC®)
Presented at various utility companies and utility associations around the northwest.
- OSHA 1919.269: Electric Power Generation, Transmission and Distribution
Presented web seminars and provided eLearning for various utility companies across the United States.
- OSHA 1919.268: Telecommunications
Presented web seminars and provided eLearning for various utility companies across the United States.
- Distribution Line Design
Presented web seminars for various utility companies across the United States.
- Arc Flash Hazards and Arc Rated Clothing
Presented web seminars for various utility companies across the United States.

Awards

IEEE Senior Engineer Membership Award

SSR Engineers, Inc. 15 year service award

HDR Engineering, Inc. Professional Associates and Pathfinders Award

Professional Affiliations

Institute of Electrical and Electronics Engineers (IEEE), Senior Member Status

IEEE Power Engineering Society (PES)

National Society of Professional Engineers (NSPE)

Montana Society of Professional Engineers (MSPE)

Licensure

Professional Engineer, State of Montana, License Number 9428PE

Professional Engineer, State of Idaho, License Number 6426

Professional Engineer, State of Washington, License Number 39601